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NATURAL GAS AND CERTAIN COMPONENTS

TSUS Item 475.15

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F O R E W O R D

Each Summary of Trade and Tariff Information is part of a series published by the United States International Trade Commission to provide information on conditions of competition between domestic and foreign products. This report, generally covering the period 1976 through 1980, is one of many being published in the current series of summaries.

This series provides comprehensive coverage of product uses, the domestic industry, U.S. consumption, production, and trade, and the domestic and international markets in each commodity area. The summaries are cast in terms of the eight schedules of the Tariff Schedules of the United States (TSUS).

The current series will consist of approximately 600 individual reports. The Commission will issue updated statistical tables and industry status reports as appropriate for individual summaries. The overall program will run several years, ultimately covering all items of the TSUS.

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Executive Summary

The items covered in this summary are natural gas, methane, ethane, propane, butane, and mixtures of these items as provided for in items 475.15 of the Tariff Schedules of the United States (TSUS). Natural gas is used as a fuel and as a petrochemical feedstock and is produced in conjunction with crude petroleum or by itself. Natural gas liquids (NGL's), ethane, propane, butane, and others are removed from the natural gas. NGL's are also used as fuels and as petrochemical feedstocks. The U.S. and most foreign rates of duty (except Mexico) for these items are free.

In the United States, Texas and Louisiana are the major States producing natural gas. Most of the petroleum companies in the United States produce natural gas simultaneously with crude petroleum from many wells. Employment in the industry remained stable during 1976-80. The United States has been the leader in scientific and technological advances and innovations in the processes used to extract natural gas, as well as the construction of new natural-gas-processing plants.

Total value of consumption increased from 1976 to 1980, and should continue to increase primarily as a result of the price decontrol of crude petroleum. Wellhead prices for natural gas have been increasing from 1976 to 1980 and as a result, the prices of ethane, propane, and butane have also increased. Natural gas prices are regulated by the U.S. Department of Energy under the Natural Gas Policy Act of 1978; however, price controls were lifted from the NGL's on January 28, 1981.

Natural gas discoveries begin at the wellhead and are either sent to natural-gas-processing plants to separate the NGL's or are piped via transmission

companies to industrial consumers or to the distribution companies. The natural gas is then transmitted through the city gate before reaching local utility companies. Natural gas and its components are used as fuel by the industrial, commercial, and residential sectors of the economy. Demand by the industrial consumers for natural gas increased as supplies increased; industrial sales in 1979 accounted for 50 percent of total industry sales.

Potential supplemental sources of natural gas include imports from Canada and Mexico, Alaskan gas, synthetic natural gas, liquid natural gas imports, and other technologies. U.S. production of natural gas increased but only minimally during 1976-80. Production of ethane increased from 1978 to 1980; production of propane remained stable during 1976-80; and production of butane decreased slightly during 1976-80. U.S. imports of natural gas, propane, and butane increased during 1976-80; however, there is little ethane trade because of its importance in the production of ethylene and the expense of shipment. Most U.S. imports of natural gas and its components come from Canada and Mexico because of the ease of transportation via pipelines as opposed to the expense of ocean shipment.

Natural gas usage in other nations of the world is not as widespread as in the United States since many industrialized nations have few natural gas resources or lack the pipeline infrastructure necessary to transport natural gas to local markets. However, Canada, Mexico, North Africa, and the Mideast countries are striving to develop their natural gas resources and markets. U.S. exports of natural gas decreased during 1976-80, as a result of the high costs associated with transportation. As stated previously, there is little trade in ethane. U.S. exports of propane and butane are relatively small in comparison with U.S. production; exports could decrease as the major recipient of the U.S. exports, Mexico, develops its own resources.

Description and Uses

Commodity	TSUS item No.
Natural gas, methane, ethane, propane, butane, and mixtures thereof	475.15

Note.--For the statutory description, see excerpt from the Tariff Schedules of the United States Annotated (1981) in app. A. A concordance of the Tariff Schedules of the United States (TSUS) items included in this summary with related categories in other production, export, and import nomenclatures is found in appendix B.

The items covered by this summary are natural gas, methane, ethane, propane, butane, and mixtures of these items.

Natural gas

Natural gas is used as a fuel and petrochemical feedstock, and it is produced in conjunction with crude petroleum or by itself, and is primarily composed of low molecular weight hydrocarbons. The composition of natural gas varies according to its source. "Wet" natural gas is a term used to describe natural gas as recovered from a well, whereas "dry" natural gas is a term used to describe natural gas that has had portions removed as natural gas liquids. NGL's are composed of ethane, propane, butane, natural gasoline and isopentane, plant condensate, and other heavier components.

Wet natural gas is composed primarily of methane, ethane, propane, and butane as well as some heavier hydrocarbons. These heavier hydrocarbons are valuable and are recovered at natural-gas-processing plants, lease separators, and field facilities.

Methane

Methane, the major constituent of natural gas, is a colorless, odorless, tasteless, flammable gas which is lighter than air. It is the principal feedstock in the production of ammonia, methanol, and acetylene. It also has wide use in natural gas as a fuel in industry, commercial buildings, and homes.

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Etnane

Ethane is a colorless, odorless, flammable gas which is slightly denser than air and yet relatively inactive chemically. Most ethane is obtained by extraction from natural gas. Less than 10 percent of ethane production is obtained from refineries and is usually mixed with ethylene. Almost all recovered ethane is used as a petrochemical feedstock and about half of the ethylene produced in the United States is based on ethane. Small quantities of ethane are used for the manufacture of petrochemicals, infrequently as a fuel, or for the Btu enrichment of synthetic natural gas (SNG), and for blending into natural gas in pipelines to increase its Btu value. Ethane supplies are dependent on the quantity of natural gas produced and on the quantity extracted from the natural gas. The trend toward increased percentage recovery at gas-processing plants is counterbalanced by an overall decline in the ethane content of natural gas. A reduction in ethane extraction from natural gas would affect the availability of ethane feedstock for the petrochemical industry.

Small quantities of ethane are also recovered from refinery gases resulting from the processing of crude petroleum and as a byproduct during the production of ethylene from naphtha or gas oil.

Propane

Propane is a colorless, flammable gas that is heavier than air. It is derived primarily from natural gas. The quantity and purity of the propane obtained from the natural gas depends greatly on the processes used. Refrigerated absorption processes yield propane with a purity of 98 liquid volume percent, while the use of extremely low temperature techniques (i.e., cryogenic processes) yields propane with a purity of 99 liquid volume percent.

Propane below 90 liquid volume percent purity is often used as fuel and is often called liquefied petroleum gas (LPG). Mixtures of ethane and propane, and propane and butane may be used as fuel and can be used as a petrochemical feedstock.

Butane 1/

Butane is a colorless gas and actually consists of a mixture of n-butane, 2/ and isobutane 3/ obtained from the processing of natural gas or the refining of crude petroleum. The quantity of butane recovered from natural gas depends on the butane content of the natural gas and the processing techniques used.

1/ In this summary, butane refers to a mixture of n-butane and isobutane.

2/ Hydrocarbons whose molecules contain a straight chain of carbon atoms are designated as n-butane (normal butane).

3/ Isobutane is a colorless gas derived from wet natural gas, refinery gas, or from the isomerization of butane. Its primary uses are as a fuel, refrigerant, or a starting material for organic synthesis.

Butane is used in the manufacture of gasoline, liquid fuel used for applications in home and commercial heating and industrial uses, and as a petrochemical feedstock. Its availability is to a degree influenced by the demand for gasoline. It is used in the production of alkylate, which is a primary constituent of gasoline.

Customs Treatment

U.S. customs treatment

The provisions of the TSUS, reproduced as appendix A, show the current rates of duty which apply to natural gas, methane, ethane, propane, butane, and mixtures thereof. The column 1 1/ rate and column 2 2/ rate of duty are both free as provided for under paragraph 1733 of the Tariff Act of 1930.

Other than the problems of transportation, there are no duties associated with the importation into the United States of natural gas and its components at present, although the U.S. Department of Energy does investigate proposed imports of liquefied natural gas (LNG) in relation to prices and environmental restrictions. However, from time to time, certain components have been subject to other fees, restrictions, and so forth, administered by the U.S. Department of Energy. At this time, as a result of Presidential Proclamation 4655 of April 6, 1979, there are no license fees or duties on the importation of the items covered by this summary.

Foreign customs treatment

The Customs Cooperation Council Nomenclature (CCCN), formerly the Brussels Tariff Nomenclature (BTN), is used as the basis for tariff classifications in countries with the principal exceptions of the United States and Canada. Natural gas, methane, ethane, propane, butane, and other petroleum gases and gaseous hydrocarbons are classified in heading 27.11 in the CCCN; separate chemically defined ethane, butane, and other petroleum gases and gaseous hydrocarbons are classified in heading 29.01, separate chemically defined methane and propane, however, are always classified in heading 29.01.

The following table summarizes the rates of duty for imports into foreign markets.

1/ The rates of duty in rate of duty column numbered 1 are Most-Favored-Nation (MFN) rates, and are applicable to imported products from all countries except those Communist countries and areas enumerated in general headnote 3(f) of the TSUS. However, such rates would not apply to products of developing countries which are granted preferential tariff treatment under the GSP.

2/ The rates of duty in rate of duty column numbered 2 apply to imported products from the Communist countries and areas enumerated in general headnote 3(f) of the TSUS.

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Natural gas, methane, ethane, propane, butane, and mixtures thereof: Selected rates of duty, present and negotiated, in principal foreign markets for U.S. exports.

Market	Description of commodity and foreign tariff item No.	Present rate of duty 1/	Negotiated rate of duty 2/
Canada	Hydrocarbons:		
	Other than the following hydrocarbons (92901-1):		
	Butanes (92901-4)	Free	Free
	Propanes (92901-12)	Free	Free
EC	Petroleum gases and other gaseous hydrocarbons: (27.11)		
	A. Propane of a purity less than 99%:		
	I. For use as a power or heating fuel.	17.1% ad val.	12% ad val.
	II. For other uses	Free	Free
	B. Other:		
	Commercial propane and butane	1.5% ad val.	1.5% ad val.
	C. Other	1.5% ad val.	1.5% ad val.
	Hydrocarbons: (29.01)		
	A. Acyclic:		
	I. For use as power or heating fuels.	16.1% ad val.	12% ad val.
	II. For other purposes	Free	Free
Japan	Petroleum gas and other gaseous hydrocarbons:		
	Liquefied methane gas (27.11)	15.8% ad val. 3/	3% ad val.
	Saturated acyclic hydrocarbons (29.01A).	7.5% ad val.	5.8% ad val.
Mexico	Natural gas, methane, ethane, propane, butane, and certain mixtures (27.11).	5% ad val. 4/	5/

1/ Rate currently applicable to imports from the United States.
2/ Rate negotiated under the MTN.
3/ The temporary rate of duty is free.
4/ Natural gas and certain components of natural gas transmitted via pipelines are exempt from duty; however an import license is required.
5/ Mexico did not participate in the agreements reached at the MTN.

U.S. Industry

Basic data and information

In the United States, Texas and Louisiana are the major States producing natural gas, accounting for an estimated 70 percent of total marketed production. Areas in North Dakota, the Rocky Mountains, and offshore Louisiana are expected to yield new finds of natural gas in the early 1980's, while the Alaskan discoveries are not expected to add significantly to U.S. production until the late 1980's.

Most of the petroleum companies in the United States produce natural gas. It is produced simultaneously with crude petroleum from many wells or by itself. Often, when a well is drilled looking for crude petroleum, natural gas is discovered instead. Therefore, separate data on the natural gas industry as opposed to the crude petroleum industry are often not available. Standard Industrial Classifications (SIC) industry number 1311 encompasses both crude petroleum and natural gas production because of the close relationship between the production of both. Separate data for these two items in terms of employees, investment, and so forth are not available. Employment in the crude petroleum and natural gas industry was estimated at 140,000 workers at the beginning of 1980. However, as stated previously, because of the close relationship between crude petroleum production and natural gas production, data are not available which allocate employees by production of each.

Employment in the natural gas liquids industry remained stable during 1975-80. In 1979, there were approximately 12,200 employees in the industry, an increase of 12 percent over the number of employees in 1972 when there were 10,700 workers. 1/ Of total employment, approximately 65 percent of the employees are considered to be production workers. Estimates of productivity in the industry show a steady increase since 1967.

Although there have been some technological advances and innovations in the processes used to extract natural gas, as well as to construct new plants for the processing of natural gas, the natural gas industry does not rely on highly skilled labor. The industry is, however, capital intensive.

The United States has been the leader in natural gas scientific and technological advances in the past. The recent resource discoveries in Canada, Mexico, and other nations, plus subsequent activity and plant construction in many of these nations does indicate, however, that the United States may be pressed in the future to maintain its leadership position.

Natural gas liquids.--There are approximately 760 natural-gas-processing plants operating in the United States, 2/ however, there are complex aspects dealing with the ownership of natural gas streams. Often, NGL's are removed

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1/ Oil & Gas Journal, June 25, 1980, p. 12.

2/ Annual Survey of Manufactures, Industry Profiles, Bureau of the Census, U.S. Department of Commerce.

from natural gas streams in the field and piped to a fractionator. 1/ The field and fractionator could be operating under different ownership.

Ethane.--There are approximately 85 natural-gas-processing plants in the United States that extract ethane and another 30 plants that extract ethane/propane mixtures. 2/ The four largest producers of ethane accounted for approximately 40 percent of the total U.S. production while the remaining plants together accounted for the remaining 60 percent in 1979. 3/

There are no individual production data on a company-by-company basis available on ethane production by petroleum refineries in the United States. It is estimated that the 20 largest refineries accounted for 78 percent of the total ethane production from refineries in 1980. 4/

Propane.--There are approximately 290 gas-processing plants in the United States producing propane, 30 plants producing ethane/propane mixtures, and 60 plants producing propane/butane mixtures. The 10 largest companies accounted for over 60 percent of the total propane produced from natural gas streams, while the remaining 40 percent is accounted for by other companies, most of which are relatively small plants. 5/

Propane can also be produced by petroleum cracking and reforming operations. Approximately 75 U.S. refineries have the potential to produce propane. The largest producer accounts for approximately 11 percent of total propane production by petroleum refineries. 6/ The four largest firms accounted for about 35 percent and the eight largest firms accounted for nearly 55 percent of total propane production in refineries in 1980. 7/

Butane.--In 1980 there were approximately 200 gas-processing plants producing butane in the United States. The largest U.S. producer of butane accounted for approximately 25 percent of total annual production. The four largest firms accounted for an estimated 48 percent and the eight largest firms accounted for approximately 66 percent of total annual production. 8/

Butane can be extracted from petroleum refinery streams. No individual production data on a company-by-company basis are available; however, it is estimated that 20 large U.S. refineries account for 75 percent of total butane production from petroleum refining operations. 9/

1/ Natural gas is separated into components (NGL's) by means of the process of fractionation using methods of distillation or crystallization.
2/ Oil & Gas Journal, June 25, 1980, p. 12.
3/ Ibid.
4/ Ibid.
5/ Ibid., p. 16.
6/ Ibid.
7/ Ibid.
8/ Ibid.
9/ Ibid., p. 30.

Financial information

As previously mentioned, separate data for natural gas, ethane, propane, and butane are not available because of the close relationship with crude petroleum production. October-December 1980 earnings of the 25 largest petroleum refiners showed a slight decrease of less than 1 percent from the earnings in July-September 1980. The five largest petroleum refiners showed an average after tax margin of only 4.4 percent in October-December 1980 as compared with 4.9 percent in July-September 1979. 1/

Total value of consumption of natural gas was approximately $11.4 billion in 1976, $17.6 billion in 1977, $20.9 billion in 1978, $25.9 billion in 1979, and $36.0 billion in 1980 (table 1, app. C). Sales could increase partly as a result of ample supplies and the value of sales may increase partly as a result of the decontrol of petroleum prices in the early 1980's. The largest profit gains should be experienced by the large, diversified, energy-related firms.

On price setting

Under the Natural Gas Policy Act (NGPA) of 1978, the price of natural gas was to be gradually decontrolled by 1985; however, the Administration is currently studying a proposal which would call for full decontrol before the expiration date.

The Administration's proposal could raise the ceilings on newly discovered gas by 25 to 40 percent as well as decontrol high risk gas, such as that which is extracted from deep reservoirs, geopressured brine formations, and other sources which incur high development costs. If such a plan were to be implemented, it is estimated that prices to consumers would increase as gas prices reached parity with oil prices.

Price controls from the early 1960's through 1978 were the primary reason for decreasing production. As a result of a 1954 Supreme Court decision, 2/ the price of gas produced and sold within a State is unregulated; however, if gas is produced in one State and sold in another, the Federal Power Commission 3/ was empowered to regulate prices at the wellhead. The cost of natural gas is determined at the wellhead based on service, expenditure, and inventory costs. Prices are regulated on the basis of the maximum local price established under the NGPA. Different prices are set for more recent gas discoveries. In order to charge the higher maximum local price, contractual authorization is established between producers and pipeline companies, and presented to the State jurisdictional agency. Certain criteria, established by NGPA, must be met before the State can authorize the use of the higher maximum local price. The Federal Energy Regulatory Commission (FERC) is then informed of the price increase by the State.

1/ Chemical Week, Feb. 25, 1981, p. 56.

2/ Phillips Petroleum Co. v. Wisconsin, 347 U.S. 672.

3/ The Federal Energy Regulatory Commission, within the U.S. Department of Energy, has retained the functions of the former Federal Power Commission.

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The following tabulation, compiled from official statistics of the U.S. Department of Energy, shows the average wellhead prices for natural gas, ethane, propane, and butane:

Year	Natural gas	Ethane	Propane	Butane
	Cents per thousand cubic ft.	Cents per pound		
1976	58	3.5	7.3	6.0
1977	79	4.7	5.8	6.6
1978	91	4.8	5.3	5.8
1979	115	5.3	6.4	10.3
1980	160	5.6	7.9	11.6

Natural gas.--As shown above, the price of natural gas has been increasing. Phased decontrol of natural gas prices was aimed at providing incentives for exploration and production; however, prices to users are expected to rise as natural gas prices increase toward parity with oil prices in 1985.

Ethane.--Price controls on ethane were lifted by the Administration on January 28, 1981. Increased ethane prices reflect continued increases in the price of natural gas, therefore, ethane prices are heavily dependent upon Government action on natural gas pricing. The minimum price of ethane reflects its Btu value in the natural gas stream plus the cost of separation and piping to the purchaser.

Propane.--Propane prices had been controlled by the U.S. Department of Energy; however, on January 28, 1981, the Administration lifted all controls on propane. Some energy markets are price sensitive while others are not. For example, propane is price competitive with other fuels and chemical feedstocks.

Propane prices are responsive to the market they service. Prices may vary according to regions, reflecting availability. Imports of propane are increasing as a source of supply, and prices on imports vary according to the country of origin.

Butane.--Prices for butane are influenced by transportation costs, market demand, and competing energy supplies. Prices for butane were controlled, like ethane and propane, until the Administration lifted controls on January 28, 1981.

Marketing

Channels of distribution through which consumers obtain natural gas products involve few steps. Natural gas discoveries begin at the wellhead and are either sent to natural-gas-processing plants to separate NGL's or are

piped via transmission companies to industrial consumers or to distribution companies. The natural gas is then transmitted through the city gate, 1/ before reaching local utility companies (see fig. 1).

Approximately 5 percent of total natural gas production is used as raw materials for petrochemical feedstocks. The remaining 95 percent is used by residential consumers and by the commercial sector as fuel, as well as for internal combustion and utility gas.

The U.S. Market

Domestic market profile

Natural gas and its components are used as fuel by the industrial, commercial, and residential sectors of the economy. In the industrial sector, the items covered by this summary are used as both fuel and petrochemical feedstocks.

Natural gas and components thereof are used as petrochemical feedstocks for the production of primary petrochemicals, which are used to produce petrochemical products such as synthetic fibers, rubber, and plastics. These petrochemical products are in turn used to produce such items as clothing, footwear, medical goods, packaging, and so forth, for sale to the consumer (see fig. 2).

Price controls on natural gas have kept its price on a Btu basis below parity with the price of crude petroleum. The lower price caused increased consumption and lessened the incentive to increase production. The Natural Gas Policy Act of 1978 is designed to increase the price of natural gas over a period of several years through regulated decontrol and thus provide added incentive for further exploration and production.

Demand by the industrial consumer for natural gas increased as supplies increased. Industrial sales of natural gas in 1979 accounted for 50 percent of total natural gas sales, contributing 44 percent of total revenue. This is an increase from 1978 when natural gas volume was 45 percent and revenues were 40 percent of the total. The number of industrial users of natural gas rose 3 percent from 1978 to 1979 and could continue to increase, even though prices could increase by 2 percent per year through 1985. 2/

Potential supplemental sources of gas include imports from Canada and Mexico, Alaskan gas, synthetic natural gas, liquid natural gas imports, coal

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1/ The city gate refers to the point where pipelines deliver the gas to the city at which time prices are established for the purchase of the gas by the local distributors.

2/ Standard & Poors, Industry Surveys-Basic Analysis, vol.2, Oct. 23, 1980 (sec. 2), p. v-61.

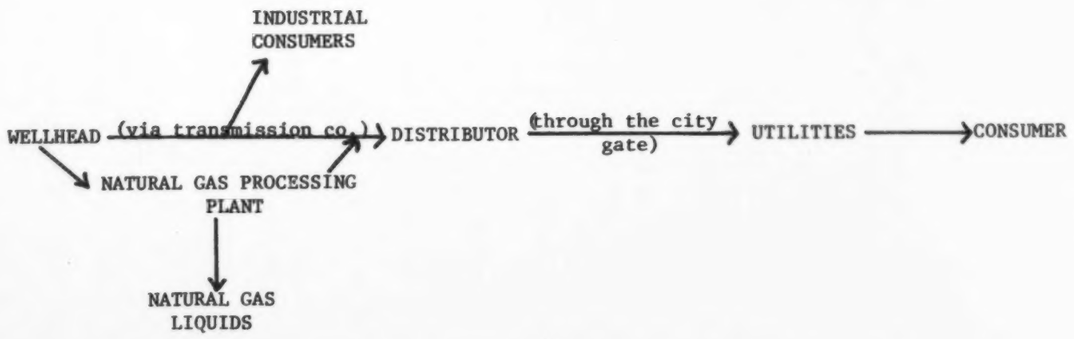

Figure 1.-- Channels of distribution for natural gas.

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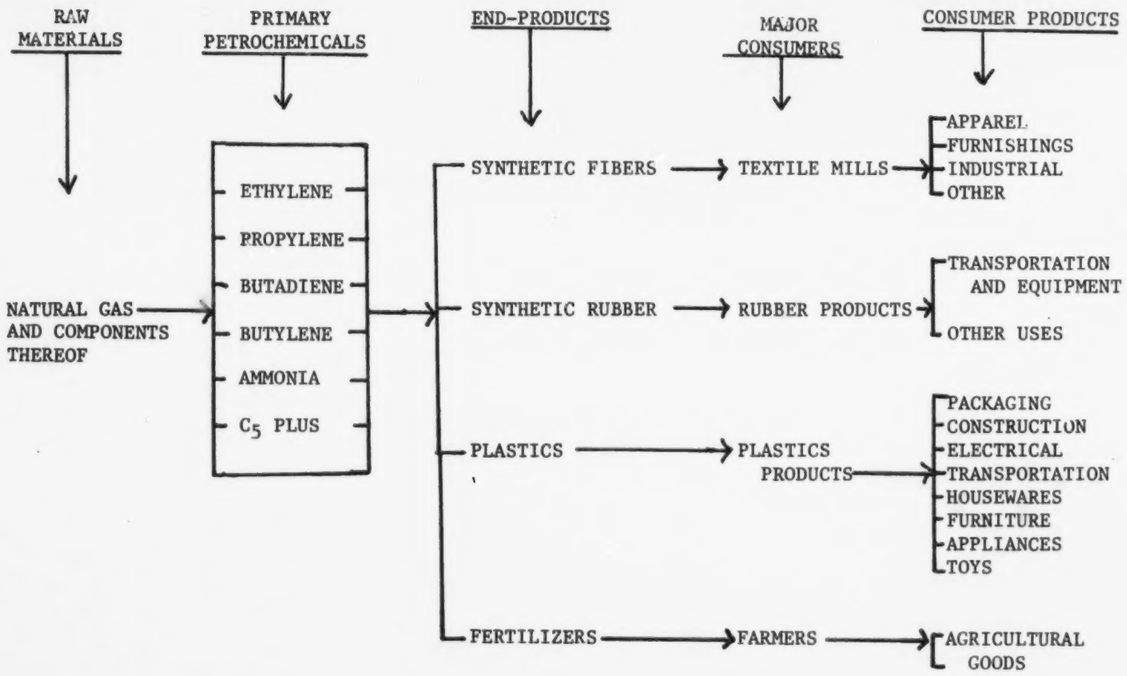

Figure 2.-- Major petrochemical product usage.

Source: U.S. Department of Commerce.

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gasification, and new technologies. The following tabulation, derived from official statistics of the U.S. Department of Energy, shows the potential contribution of these alternative gas sources:

Source	Estimated		
	1985	1990	1995
	Trillions of cubic feet		
Imports:			
Canada	2.0	1.0	1.5
Mexico	1.0	1.0	1.5
Alaska	1.0	2.0	3.0
SNG	1.0	1.0	1.0
LNG	2.0	3.0	3.0
Coal gasification	0.5	1.0	2.0
New technologies	1.0	2.0	3.0
Total	8.5	11.0	15.0

The bulk of the output of the industry is contributed by large multi-product companies, most of which are in the energy field; smaller, specialized companies deal in a limited line of end products. Most major producers also have downstream processing plants. There are complex operating patterns and connections between facilities and companies.

Most of these firms are multinational corporations headquartered in the United States. As explained in the following sections, there is little international trade relative to consumption and production in natural gas and NGL's because of the difficulty and expense of shipping; this situation could change in the future.

One advantage that the U.S. industry currently enjoys over many other nations of the world is lower costs for natural gas and NGL's owing to U.S. price controls. This price advantage is narrowing and is expected to disappear with price decontrol by 1985 or possibly earlier with the lifting of controls by the Administration.

U.S. consumption

Natural gas.--Consumption of natural gas totaled 20 trillion cubic feet in 1976; 21 trillion cubic feet in 1977 and 1978; 19 trillion cubic feet in 1979; and 21 trillion cubic feet in 1980. The ratio of imports to consumption increased from 4.7 percent in 1976 to 6.7 percent in 1979, but decreased to 5 percent in 1980 (table 1).

Consumption of natural gas by the industrial sector decreased by almost 33 percent from 1960 to 1979, however, consumption by the commercial sector doubled during the same period according to the U.S. Department of Energy. The residential sector's consumption also increased by almost 24 percent, while electric utility consumption increased by 64 percent during 1960-79.

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The following tabulation, derived from the U.S. Department of Energy, shows natural gas use by sector:

Year	Residential	Commercial	Industrial	Electric utilities
	Trillions of cubic feet			
1970	4.8	2.4	9.3	4.0
1975	4.9	2.5	8.5	3.0
1980	5.0	2.7	8.0	3.5

Consumption of natural gas increased in 1980 and could continue to increase in the early 1980's. Natural gas accounted for approximately 21 percent of total U.S. energy demand in 19); this percent could remain stable to 1985 unless full decontrol is implemented. Natural gas consumption in the residential and commercial sectors is expected to remain relatively constant because of adequate supplies.

Ethane.--Nearly all ethane produced is consumed in the manufacture of ethylene. Fuel use of ethane has been limited because of price and the availability of other fuels. Consumption of ethane declined from 61 million barrels in 1976 to 50 million barrels in 1978, but increased to 76,000 barrels in 1979, and 90,000 barrels in 1980 (table 2). The increase beginning in 1979 was the result of an increase in demand for ethylene. The ratio of imports to consumption increased from 8 percent in 1978 to 22 percent in 1979. In the early 1980's ethane use in the manufacture of ethylene is expected to continue to increase as new extraction processes remove greater quantities from the natural gas processed. Small amounts of ethane are consumed in the production of chlorinated products; however, little or no growth is expected for this use because of the importance of ethane in the manufacture of ethylene.

Propane.--The most important uses for propane are by the chemical industry in the manufacture of ethylene and coproduct propylene. Consumption of propane has been erratic since 1976 (table 3). The ratio of imports to consumption was 8 percent in 1976; 10 percent in 1977; 7 percent in 1978; 14 percent in 1979; and 9 percent in 1980. Consumption of propane as a feedstock for ethylene production could decrease in the early 1980's. A small share of propane is also consumed by residential and commercial sectors for space heating, cooking, water heating, and other such uses. Propane is also used to a lesser extent as a standby industrial fuel for industrial users or as a gasoline replacement for internal combustion engines primarily designed for use in enclosed spaces. Fewer noxious combustion products are produced by internal combustion engines using propane or LPG fuel.

Butane.--Butane used in the manufacture of gasoline components accounts for approximately 80 percent of the total consumption of butane. Liquefied fuels use and chemical production each account for approximately 10 percent of consumption. Consumption of butane increased from 1976 to 1977 and decreased in 1978; however, consumption increased in 1979 but decreased in 1980

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(table 4). Consumption could remain at these levels during the early 1980's. 1/ The ratio of imports to consumption decreased from 16 percent in 1977 to 10 percent in 1978, but increased to 17 percent per year in 1979 and 1980.

U.S. production

Natural gas.--Marketed production 2/ of natural gas in 1980 was 20 trillion cubic feet (table 1). Marketed production in 1976, 1977, and 1978 was also 20 trillion cubic feet. Marketed production of natural gas in 1979 increased slightly to 20.4 trillion cubic feet. Proven reserves in 1980 amounted to 190 trillion cubic feet. The following tabulation shows production and reserves derived from statistics of the U.S. Department of Energy:

Year	Marketed production	Proven reserves	Ratio (percent) of reserves to production
	Trillions of cubic feet		
1976	20.0	215	10.8
1977	20.0	210	10.5
1978	20.0	205	10.3
1979	20.4	195	9.6
1980	20.0	190	9.5

Production capabilities are linked to reserve levels of natural gas, and in spite of the declining ratio, there have been some signs of recovery. Total production in 1979 was somewhat higher than in 1976, as a result of increased drilling.

Ethane.--Production of ethane has been increasing since 1960. Ethane production increases resulted from increases in its extraction from natural gas streams. In 1978, approximately 98 percent of the total ethane produced was extracted from natural gas and the remaining 2 percent was produced from refinery gases, which are often used in the refinery for fuel.

Total production of ethane decreased from 61 million barrels in 1976 to 53 million barrels in 1977, or by 13 percent (table 2). Production decreased by 13 percent in 1978 to 46 million barrels, but increased 30 percent in 1979 to 60 million barrels, and showed an increase of 20 percent in 1980 to 72 million barrels (table 2). Increases are a result of increased ethane extraction capacity by producers. The availability of additional ethane extraction capacity is expected to continue through 1985.

Propane.--Historically, production of propane grew at an average annual rate of 6 percent from 1960 to 1972, but then began to decrease by

1/ Industry sources.

2/ Marketed production of natural gas represents gross withdrawals less gas used for repressuring and quantities vented and flared.

approximately 4 percent per year through 1976 when production totaled 284 million barrels. Production increased slightly from 1976 to 287 million barrels in 1977, or by approximately 1 percent, but decreased in 1978 to 281 million barrels, or by 2 percent. Production again decreased by 2 percent in 1979 to 275 million barrels, and in 1980 to 274 million barrels (table 3). The decrease in production reflects, among other things, less emphasis on propane recovery.

In 1978, 66 percent of total propane production was accounted for by natural-gas-processing plants, while 34 percent came from refineries. There could be a continued decrease in propane production from natural gas and a small increase in production from refineries.

Butane.--Production of butane decreased from 115 million barrels to 113 million barrels, or by approximately 2 percent from 1976 to 1977, and decreased by another 3 percent in 1978 to 110 million barrels. Production of butane decreased by 4 percent in 1979 to 105 million barrels, and by 1 percent in 1980 to 104 million barrels. Production of butane is expected to continue decreasing through 1985 (table 4).

U.S. imports

Natural gas.--The primary source of natural gas imports has traditionally been Canada. Imports of natural gas declined from 987 billion cubic feet in 1977 to 941 billion cubic feet in 1978, or by 5 percent, but rose by 6 percent in 1979 to 1 trillion cubic feet. The unit value per thousand cubic feet increased from $1.95 in 1977, to $2.12 in 1978; $2.18 in 1979; and $4.01 during 10 months in 1980. (table 5).

Algeria has been a major supplier of LNG to the United States. There were no imports of LNG from Algeria reported in 1976 as a result of previous mechanical failures at the Arzew, Algeria plant, which shut down production.

Algeria's national oil and gas company (SONATRACH) entered into a 25-year contract with a U.S.-based company, with the appropriate approval of the Federal Power Commission, which called for daily shipments of LNG beginning in 1977. The price to be charged for the LNG was established in the long-term contract. In 1980, U.S. imports of Algerian LNG decreased as a result of a price dispute. Algeria has halted all LNG shipments to the United States until a settlement can be reached.

Ethane.--Although U.S. imports of ethane appear to have increased (tables 2 and 6) from 9,000 barrels in 1977 to 19 million barrels 1980, in actuality, imports increased only minimally. The increase shows ethane shipped from Alberta, Canada, to Sarnia, Ontario, via the Cochin pipeline which passes into the United States. Actually, there is little ethane trade; however, virtually all imports of ethane come from Canada.

Propane.--Propane imports grew steadily, increasing by 21 percent, from 25 million barrels in 1976 to 31 million barrels in 1977 (table 7). Approximately 21 million barrels were imported in 1978. Increasing demand in 1979 forced increases in propane imports to reach 33 million barrels; however, imports decreased to 26 million barrels in 1980. Canada is the main source of

supply for propane, accounting for over 70 percent of total U.S. imports. In the 1980's Canada could be joined by Mexico, the Middle East, North Africa, and Venezuela as major suppliers of propane to the United States.

Butane.--U.S. imports of butane are reported as butane with at least a purity of 90 liquid volume percent and butane/propane mixtures. Imports of butane decreased by 43 percent, from 21 million barrels in 1977 to 12 million barrels in 1978, but increased to 21 million barrels in 1979 and 1980 (table 8). Imports of butane are expected to continue to rise through 1983, as new plants, in Canada and the Middle East, come onstream.

The International Market

International market profile

Natural gas.--Natural gas usage in the other nations of the world is not as widespread as it is in the United States. Many industrialized nations have few natural gas resources and lack the pipeline infrastructure necessary to use natural gas even if it was available. Other nations, such as those in OPEC, possess natural gas resources and produce natural gas, but lack local markets and a pipeline system. Often these nations flare, or burn in the atmosphere with no commercial return, the natural gas that is produced, altnough many of these nations are now planning ways to commercially utilize tnis natural gas.

Natural gas trade has taken place between Canada, Mexico, and the United States for sometime. According to the Canadian Petroleum Association, Canada's reserves exceeded 89 trillion cubic feet in 1979. The Province of Alberta accounted for 83 percent of Canada's total reserves, and the frontier areas of the Arctic Islands, the MacKenzie Delta, and the Beaufort sea regions account for the other 17 percent of reserves. There is no commercial production mainly because of limited local markets and the absence of pipelines in these areas to carry the natural gas to consumption centers or liquefaction plants to make LNG for export.

Some sections of the United States, such as the Midwest and Pacific Northwest States are heavily dependent on Canadian natural gas, consuming approximately 90 percent of total U.S. imports from Canada. Prices of Canadian gas are increasing. In the latter portion of 1980, natural gas from Canada sold at $4.12 per thousand cubic feet in comparison with $2.31 per thousand cubic feet in 1979 (table 5).

The Canadian industry uses revenues from natural gas sales to the United States in order to further develop its resources. The United States benefits from the ease of transportation of natural gas located so close to its borders.

After years of negotiations, additional natural gas from Mexico entered the United States in early 1980. Under an agreement between a U.S.

joint-venture 1/ and Petroleos Mexicanos, 2/ an estimated 300 million cubic feet per day of natural gas was imported into the United States.

Mexico is an important source of natural gas for the U.S. market. Mexico's reserves are large and it seems each successive estimate of reserves is larger. An estimated 80 trillion cubic feet of proven natural gas reserves and an additional 300 trillion cubic feet of potential reserves are available in Mexico. 3/

Production of natural gas in Mexico has increased over the last 10 years. Mexico's energy needs have also increased, but the Government hopes to develop reserves slowly so as to avoid economic disruptions. Mexico is expected to be a major source of U.S. imports in the future based on availability of resources and ease of transportation via pipelines.

Ethane.--Ethane usage outside of the United States is relatively small. In most countries, heavy liquid feedstocks, such as naphtha and gas oil, are principally used in the production of ethylene. However, Western Canada and Mexico are developing manufacturing operations and are expected to be major world suppliers of ethane in the 1980's. Other regions, such as the Mideast, North Africa, the North Sea, and Indonesia are also developing supplies of natural gas and planning extraction of ethane for ethylene manufacture. As a result of limited infrastructure, however, many of these projects may develop slowly.

Propane.--Recovery of propane outside the United States is also limited. Most propane is consumed internally as plant refinery fuel thus creating a limited market. However, planned plant construction in the Mideast and North Africa to extract NGL's from natural gas could result in a world surplus in the future. The Middle East nations are expected to possibly become the world's major exporters of NGL's in the 1980's.

Butane.--Ample supplies of butane are expected to be provided by increasing production in the Middle East and North Sea areas. Worldwide demand for butane is expected to increase while end uses will vary on a country-by-country basis. The emphasis on gasoline manufacture in the United States will result in this country remaining a leader in downstream butane consumption.

U.S. exports

Natural gas.--U.S. exports of natural gas are negligible, accounting for less than 1 percent of U.S. output. The cost of transporting natural gas is high, therefore, little is exported when seen in comparison with U.S. production.

Natural gas, as an economical source of fuel or chemical feedstock, largely depends upon the costs involved in transporting it between points of

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1/ The U.S. joint-venture consists of several U.S.-based oil and pipeline companies.

2/ Petroleos Mexicanos (Pemex) is the state-owned oil company in Mexico.

3/ Standard & Poors, p. u-69.

production and consumption. In order to reach likely markets over considerable distances, natural gas must be transported by gas pipeline or in the form of LNG; in either case, large capital investments are necessary.

Gas pipelines, once laid, are fixed in direction and capacity. Although large initial investments are required, these costs are, in due course, offset by the low unit cost of transportation.

Expensive insulation and specialized equipment are needed to transport LNG by tanker. LNG requires special facilities for reception, revaporation, and distribution which may not be available in many developing nations.

U.S. exports of natural gas decreased by 43 percent, from 96 billion cubic feet in 1976 to 55 billion cubic feet in 1977. Exports increased to 57 billion cubic feet in 1978 and increased to 60 billion cubic feet in 1979. Exports decreased 28 percent in 1980 to 43 billion cubic feet (tables 1 and 9). Prices per unit of natural gas (methane) exports increased from $2.03 per thousand cubic feet in 1978 to $2.18 per thousand cubic feet in 1979; however, prices almost doubled in 1980 to $4.00 per thousand cubic feet (table 9).

Japan is the major market for U.S. exports of natural gas, accounting for over 90 percent of the total U.S. exports in 1980. Alaskan LNG is exported, primarily to Japan, rather than shipped to the lower 48 States because there are no receiving terminals on the U.S. Pacific coast and the Merchant Marine Act, 1920 (the Jones Act) (46 U.S.C. 883) requires U.S. flagships to carry interstate seaborne trade; however, no U.S. flag LNG tanker exists.

Another major export market for natural gas is Mexico. As Mexican resources are developed, these exports may decrease.

Ethane.--There is essentially no export trade in ethane because of its importance in the manufacture of ethylene in the United States, limited applications in other countries, and difficulties in shipping as it would have to be liquefied for ocean shipment. For these reasons, most countries find it more advantageous to produce their own ethane or develop or import supplies of heavy liquid feedstocks. U.S. exports of ethane totaled 2,000 barrels in 1978 and 1980, and totalled 1,000 barrels in 1979 (tables 2 and 10).

Propane.--U.S. exports of propane are also relatively small as compared with domestic production. Exports rarely exceed 1 percent of domestic production and usually go to Mexican markets. Exports of propane decreased from 2 million barrels in 1976 to 1.6 million barrels in 1977, and decreasing to 1.1 million barrels in 1978. U.S. exports of propane increased by 27 percent to 1.4 million barrels in 1979, but decreased by 21 percent in 1980 to 1.1 million barrels (tables 3 and 11).

Butane.--Exports of butane decreased by 56 percent, from 257,000 barrels in 1976 to 112,000 barrels in 1977, but increased to 477,000 barrels in 1978. Exports decreased to 447,000 barrels in 1979, but decreased by 42 percent in 1980 to 279,000 barrels (tables 4 and 12). This trend of declining exports is expected to continue as Mexico, the largest recipient of U.S. exports, develops its own resources.

Appendix A

Part 10, of Schedule 4 of the Tariff Schedules of the United States Annotated (1981)

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GSP	Item	Stat. Suffix	Articles	Units of Quantity	Rates of Duty		
					1	LDDC	2
			PART 10. - PETROLEUM, NATURAL GAS, AND PRODUCTS DERIVED THEREFROM 1/				
			Part 10 headnotes:				
			1. Any product described in this part and also in part 1 of this schedule is classifiable in said part 1, except fuel oils, motor fuel, and lubricating oils and greases, containing by weight not over 25 percent of any product described in said part 1. This part does not cover -- (i) paraffin and other petroleum waxes (see part 13B of this schedule), or (ii) petroleum asphalts (see part 1J of schedule 5).				
			2. For the purposes of this part -- (a) "Reconstituted crude petroleum" (items 475.05 and 475.10) is a product which is essentially the equivalent of crude petroleum and which is made by adding fuel oil, naphtha, or other petroleum fractions to crude or topped crude petroleum; and (b) "Motor fuel" (item 475.25) is any product derived primarily from petroleum, shale, or natural gas, whether or not containing additives, which is chiefly used as a fuel in internal-combustion or other engines.				
			3. For the purposes of items 475.65 and 475.70 of this part -- (a) a product is considered to be in liquid form if --				

1/ Pres. Proc. 4766 of June 19, 1980, continues through December 31, 1980, the suspension of the system of license fees on petroleum and petroleum products established by Pres. Proc. 4210 (38 F.R. 9645) of February 1, 1975 and rescinds Pres. Proc. 4744 of April 2, 1980, in its entirety. However, the temporary suspension of duties pursuant to Pres. Proc. 4655 of April 6, 1979, as extended, has expired and such duties are, therefore, reimposed on July 1, 1980. For details of the February 1, 1975 action, including the system of fees for licenses, see Pres. Proc. 4210 (38 F.R. 9645), as modified by Pres. Proc. 4227 (38 F.R. 16195), Pres. Proc. 4317 (39 F.R. 35103), Pres. Proc. 4341 (40 F.R. 3965), Pres. Proc. 4355 (40 F.R. 10437), Pres. Proc. 4370 (40 F.R. 19420), Pres. Proc. 4377 (40 F.R. 23429), Pres. Proc. 4412 (41 F.R. 1037), Pres. Proc. 4543 (42 F.R. 64849), and Pres. Proc. 4629 (47 F.R. 58077).

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GSP	Item	Stat. Suffix	Articles	Units of Quantity	Rates of Duty		
					1	LDDC	2
			(i) the penetration is more than 350 units (35 millimeters) when tested by the procedure and equipment specified in American Society of Testing Materials (ASTM) Designation: D-5 with the use of a 50-gram load for 1 second at 77°F., or when tested by a procedure which provides equivalent results, and (ii) such product is not in an essentially gaseous state at a temperature of 60°F. and at a pressure of 14.65 pounds per square inch (absolute), regardless of the condition of the product at the time of importation; and (b) in determining the relative weights of components of the mixtures provided for in items 475.65 and 475.70, naphtha and other petrol[illegible]erivatives which may be present in such mixtur[illegible]solvents shall be disregarded. 4. (a) For purposes of this headnote, the term "petroleum" means crude petroleum (including reconstituted crude petroleum) or crude shale oil provided for in items 475.05 or 475.10. (b) Petroleum shall, if a product of Canada, be admitted free of duty and any entry therefor shall be liquidated or reliquidated accordingly if, on or before the 180th day after the date of entry, documentation is filed with the customs officer concerned establishing that, pursuant to a commercial exchange agreement between United States and Canadian refiners which has been approved by the Secretary of Energy-- (i) an import license for the petroleum covered by such entry has been issued by the Secretary; and (ii) an equivalent amount of domestic petroleum or duty-paid foreign petroleum has, pursuant to such commercial exchange agreement and to an export license issued by the Secretary of Commerce, been exported from the United States to Canada and has not previously been used to effect the duty-free entry of like Canadian products under this headnote. (c) The Secretary of the Treasury, after consulting with the Secretary of Commerce and the Secretary of Energy, shall issue such rules or regulations as may be necessary governing the admission of Canadian products pursuant to the provisions of this headnote. Part 10 statistical headnote: 1. For the purposes of this part the term barrel (Bbl.) means a barrel of 42 U.S. standard gallons measured at 60°F.				

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GSP	Item	Stat. Suffix	Articles	Units of Quantity	Rates of Duty 1	Rates of Duty LDDC	Rates of Duty 2
			Crude petroleum (including reconstituted crude petroleum); topped crude petroleum; crude shale oil; and distillate and residual fuel oils (including blended fuel oils) derived from petroleum, shale, or both, with or without additives:				
	475.05		Testing under 25 degrees A.P.I.....	.....	0.125¢ per gal.		0.5¢ per gal.
		10	Crude petroleum (including reconstituted crude petroleum) and crude shale oil.....	Bbl.			
			Other:				
		25	Having a Saybolt Universal viscosity at 100°F. of 45 seconds or more but not more than 125 seconds (No. 4-type fuel oils).....	Bbl.			
		35	Having a Saybolt Universal viscosity at 100°F. of more than 125 seconds (heavy fuel oils).....	Bbl.			
		45	Other.....	Bbl.			
	475.10		Testing 25 degrees A.P.I. or more.....	.....	0.25¢ per gal.		0.5¢ per gal.
		10	Crude petroleum (including reconstituted crude petroleum) and crude shale oil.....	Bbl.			
			Other:				
		15	Having a Saybolt Universal viscosity at 100°F. of less than 45 seconds (light fuel oils).....	Bbl.			
		25	Having a Saybolt Universal viscosity at 100°F. of 45 seconds or more but not more than 125 seconds (No. 4-type fuel oils).....	Bbl.			
		35	Having a Saybolt Universal viscosity at 100°F. of more than 125 seconds (heavy fuel oils).....	Bbl.			
	475.15		Natural gas, methane, ethane, propane, butane, and mixtures thereof.....	.....	Free		Free
		05	Natural gas, methane and mixtures thereof (including liquefied natural gas and synthetic or substitute natural gas).....	MCF 1/			
		15	Ethane with a minimum purity of 95 liquid volume percent.....	Bbl.			

1/ Thousand cubic feet.

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GSP	Item	Stat. Suffix	Articles	Units of Quantity	Rates of Duty		
					1	LDDC	2
	475.15 (con.)		Natural gas, methane, ethane, propane, butane, and mixtures thereof (con.):				
		25	Propane with a minimum purity of 90 liquid volume percent	Bbl.			
		35	Butane with a minimum purity of 90 liquid volume percent	Bbl.			
			Other:				
		45	Mixtures containing more than 90 liquid volume percent of propane and butane	Bbl.			
		50	Mixtures containing more than 90 liquid volume percent of ethane and propane	Bbl.			
		55	Other	X			
	475.25		Motor fuel		1.25¢ per gal.		2.5¢ per gal.
		20	Gasoline	Bbl.			
		30	Jet fuel, naphtha-type	Bbl.			
		50	Jet fuel, kerosene-type	Bbl.			
		60	Other	Bbl.			
	475.30	00	Kerosene derived from petroleum, shale oil, or both (except motor fuel)	Bbl.	0.25¢ per gal.		0.5¢ per gal.
	475.35	00	Naphthas derived from petroleum, shale oil, natural gas, or combinations thereof (except motor fuel)	Bbl.	0.25¢ per gal.		0.5¢ per gal.
	475.40	00	Mineral oil of medicinal grade derived from petroleum, shale oil, or both	Gal.	0.2¢ per gal.		0.5¢ per gal.
			Lubricating oils and greases, derived from petroleum, shale oil, or both, with or without additives:				
	475.45	00	Oils	Bbl.	2¢ per gal.		4¢ per gal.
			Greases:				
A	475.55	00	Containing not over 10 percent by weight of salts of fatty acids of animal (including marine animal) or vegetable origin	Lb.	9% ad val.	5.8% ad val.	20% ad val.
A	475.60	00	Other	Lb.	0.9¢ per lb. + 8.9% ad val.	0.6¢ per lb. + 5.7% ad val.	2¢ per lb. + 20% ad val.

Note: For explanation of the symbol "A" or "A*" in the column entitled "GSP", see general headnote 3(c).

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Appendix B

Concordance of TSUSA Numbers, Schedule B Numbers, SIC Numbers, SITC Numbers, and CCCN Numbers

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Natural gas, methane, ethane, propane, butane, and mixtures thereof: TSUSA item numbers, Schedule B numbers, SIC numbers, SITC numbers, and CCCN numbers included in this commodity group

TSUSA item No.	Schedule B No.	SIC No.	SITC No.	CCCN No.
475.1505	475.1505	1311	341.31	27.11
475.1515	475.1515	1311	341.31	27.11
475.1525	475.1525	1311	341.31	27.11
475.1535	475.1545	1311	341.31	27.11
475.1545 (pt.)	475.1570	1311	341.31	27.11
475.1550 (pt.)	475.1570	1311	341.31	27.11
475.1555 (pt.)	475.1570	1311	341.31	27.11

Appendix C

Statistical Tables

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Table 1.--Natural gas (methane): U.S. production, exports of domestic merchandise by principal markets, imports for consumption by principal sources, and apparent consumption, 1976-80

(Quantity in millions of cubic feet; value in thousands of dollars; unit value per thousand cubic feet)

Year	Production 1/	Exports	Imports	Apparent consumption	Ratio (percent) of imports to consumption
	Quantity				
1976	19,952,000	95,867	2/	19,856,133	-
1977	20,025,000	55,352	987,152	20,956,800	4.71
1978	19,974,000	57,124	941,294	20,858,170	4.51
1979	20,373,000	59,761	1,267,441	19,045,798	6.65
1980	20,063,000	43,200	1,026,490	21,046,290	4.88
	Value				
1976	11,572,160	140,854	1,925,747	11,431,306	-
1977	15,818,750	101,078	1,925,747	17,643,419	10.91
1978	18,976,340	116,194	1,994,444	20,854,590	9.56
1979	23,248,950	130,158	2,765,408	25,884,200	10.68
1980	32,100,800	184,032	4,116,224	36,032,992	11.42
	Unit value				
1976	$0.58	$1.47	-	-	-
1977	.79	1.83	$1.95	-	-
1978	.91	2.03	2.12	-	-
1979	1.15	2.18	2.18	-	-
1980	1.60	4.26	4.01	-	-

1/ Marketed production of natural gas (production representing gross withdrawls less gas used for repressuring and quantities vented and flared) was compiled from official statistics of the U.S. Department of Energy.

2/ In 1976 imports of natural gas and methane were reported along with ethane and mixtures thereof which totaled 943.4 billion barrels, valued at $1.6 billion.

Source: Compiled from official statistics of the U.S. Department of Commerce, except where noted.

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Table 2.--Ethane: U.S. production, exports of domestic merchandise by principal markets, imports for consumption by principal sources, and apparent consumption, 1976-80

(Quantity in thousands of barrels; value in thousands of dollars; unit value per barrel)

Year	Production 1/	Exports	Imports	Apparent consumption	Ratio (per cent) of imports to consumption
			Quantity		
1976	61,084	2/	3/	61,084	-
1977	53,134	2/	9	53,143	0.02
1978	46,270	2	3,937	50,205	7.84
1979	59,725	1	16,687	76,411	21.84
1980	71,670	2	19,251	90,921	21.17
			Value		
1976	322,524	2/	2/	322,524	-
1977	350,684	2/	83	350,767	0.02
1978	305,382	134	35,512	340,760	10.42
1979	394,185	142	122,665	516,708	23.74
1980	494,523	185	156,330	650,668	24.03
			Unit value		
1976	$5.28	-	-	-	-
1977	6.60	-	$9.58	-	-
1978	6.60	$ 60.40	8.26	-	-
1979	6.60	108.72	7.35	-	-
1980	6.90	92.50	8.12	-	-

1/ Compiled from official statistics of the U.S. Department of Energy.
2/ Not available.
3/ In 1976 imports of ethane were reported along with natural gas, methane, and mixtures thereof which totaled 943.4 billion barrels, valued at $1.6 billion.

Source: Compiled from official statistics of the U.S. Department of Commerce, except as noted.

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Table 3.--Propane: U.S. production, exports of domestic merchandise by principal markets, imports for consumption by principal sources, and apparent consumption, 1976-80

(Quantity in thousands of barrels; value in thousands of dollars; unit value per barrel)

Year	Production 1/	Exports	Imports	Apparent consumption	Ratio (percent) of imports to consumption
	Quantity				
1976	284,438	2,116	24,811	307,133	8.08
1977	286,791	1,558	31,454	316,687	9.93
1978	280,907	1,170	20,721	298,451	6.94
1979	275,000	1,478	33,185	239,137	13.88
1980	273,964	1,143	25,927	298,748	8.68
	Value				
1976	2,389,279	23,766	202,688	2,568,201	7.89
1977	2,867,910	17,596	287,950	3,138,264	9.18
1978	2,696,707	12,799	183,972	2,867,880	6.41
1979	2,750,000	21,155	310,750	3,039,595	10.22
1980	2,849,226	26,000	400,522	3,223,748	12.42
	Unit value				
1976	$ 8.40	$11.23	$ 8.17	-	-
1977	10.00	11.29	9.15	-	-
1978	9.60	10.94	8.88	-	-
1979	10.00	14.32	9.36	-	-
1980	10.40	23.27	15.44	-	-

1/ Compiled from official statistics of the U.S. Department of Energy.

Source: Compiled from official statistics of the U.S. Department of Commerce, except as noted.

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Table 4.--Butanes: U.S. production, exports of domestic merchandise by principal markets, imports for consumption by principal sources, and apparent consumption, 1976-80

(Quantity in thousands of barrels; value in thousands of dollars; unit value per barrel)

Year	Production 1/	Exports	Imports	Apparent consumption	Ratio (percent) of imports to consumption
	Quantity				
1976	115,200	257	2/	114,943	
1977	112,843	112	20,009	133,740	15.71
1978	109,560	477	12,463	121,546	10.25
1979	104,923	447	21,544	125,990	17.10
1980	103,864	279	20,706	124,291	16.66
	Value				
1976	1,393,920	2,676	2/	1,391,244	-
1977	1,239,016	1,345	207,653	1,445,324	14.37
1978	1,194,204	5,967	121,696	1,309,933	9.29
1979	1,091,199	5,201	273,535	1,359,533	20.12
1980	1,064,606	5,466	403,567	1,462,707	27.59
	Unit value				
1976	$12.10	$10.41	-	-	-
1977	10.98	12.01	$ 9.88	-	-
1978	10.90	12.50	9.76	-	-
1979	10.40	11.63	12.70	-	-
1980	10.25	19.59	19.49	-	-

1/ Compiled from official statistics of the U.S. Department of Energy.
2/ Not available.

Source: Compiled from official statistics of the U.S. Department of Commerce, except as noted.

Table 5.--Natural gas and methane: U.S. imports for consumption, by principal sources, 1976-79 and January-October 1979, and January-October 1980

Source	1976 1/	1977	1978	1979	January-October-- 1979	January-October-- 1980
	Quantity (1,000 cubic feet)					
Canada	0	969,825,716	874,929,142	997,883,594	795,297,050	660,337,035
Algeria	0	11,684,856	63,164,160	263,650,216	222,157,024	81,673,315
Brunei	0	1,333,701	466,682	1,500,056	1,213,773	241,810
Indnsia	0	764,313	1,125,504	1,122,864	931,862	1,271,876
Oman	0	448,380	1,220,890	1,091,744	1,091,744	119,293
Malaysa	0	202,652	124,254	730,901	713,277	977,704
All other	0	2,892,573	263,301	1,461,226	1,461,226	83,449,539
Total	0	987,152,191	941,293,933	1267,440,601	1022,865,956	828,070,572
	Value (1,000 dollars)					
Canada	-	1,898,003	1,932,158	2,468,370	1,839,581	2,720,080
Algeria	-	10,981	50,239	276,189	190,771	210,888
Brunei	-	4,637	1,765	6,735	4,944	2,051
Indnsia	-	2,674	4,168	4,992	3,763	11,002
Oman	-	1,514	4,636	4,529	4,529	888
Malaysa	-	688	471	3,492	3,378	7,539
All other	-	7,250	1,008	1,102	1,102	362,877
Total	-	1,925,747	1,994,444	2,765,408	2,048,070	3,315,324
	Unit value (per 1,000 cubic feet)					
Canada	-	$1.96	$2.21	$2.47	$2.31	$4.12
Algeria	-	0.94	0.80	1.05	0.86	2.58
Brunei	-	3.48	3.78	4.49	4.07	8.48
Indnsia	-	3.50	3.70	4.45	4.04	8.65
Oman	-	3.38	3.80	4.15	4.15	7.44
Malaysa	-	3.39	3.79	4.78	4.74	7.71
All other	-	2.51	3.83	0.75	0.75	4.35
Average	-	1.95	2.12	2.18	2.00	4.00

1/ In 1976 imports of natural gas and methane were reported along with ethane and mixtures thereof which totaled 943.4 billion barrels, valued at $1.6 billion.

Source: Compiled from official statistics of the U.S. Department of Commerce.

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Table 6.--Ethane: U.S. imports for consumption, by principal sources, 1976-79 and January-October 1979, and January-October 1980

Source	1976 1/	1977	1978	1979	January-October-- 1979	January-October-- 1980
	Quantity (1,000 barrels)					
Canada	0	9	3,937	16,687	14,517	16,289
FR Germ.	0	0	2/	0	0	0
Total	0	9	3,937	16,687	14,517	16,289
	Value (1,000 dollars)					
Canada	-	83	32,512	122,665	106,992	131,593
FR Germ.	-	-	2/	-	-	-
Total	-	83	32,512	122,665	106,992	131,593
	Unit value (per barrel)					
Canada	-	$9.58	$8.26	$7.35	$7.37	$8.08
FR Germ.	-	-	-	-	-	-
Average	-	9.58	8.26	7.35	7.37	8.08

1/ In 1976 imports of ethane were reported along with natural gas, methane, and mixtures thereof which totaled 943.4 billion barrels, valued at $1.6 billion.
2/ Less than 500 barrels.

Source: Compiled from official statistics of the U.S. Department of Commerce.

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Table 7.--Propane: U.S. imports for consumption, by principal sources, 1976-79 and January-October 1979, and January-October 1980

Source	1976	1977	1978	1979	January-October-- 1979	1980
	Quantity (1,000 barrels)					
Canada	16,602	21,999	14,819	26,616	20,080	16,584
Venez	3,999	5,734	3,487	3,303	3,148	1,578
S Arab	987	801	533	1,478	942	1,136
Kuwait	372	861	124	508	508	0
Iran	34	0	0	424	424	0
Austral	282	308	92	362	362	228
All other	2,535	1,751	1,666	493	401	722
Total	24,811	31,454	20,721	33,185	25,865	20,248
	Value (1,000 dollars)					
Canada	126,716	180,335	124,278	224,521	158,253	229,712
Venez	41,401	65,966	36,924	43,671	40,715	31,106
S Arab	10,254	10,633	5,576	19,340	10,004	27,132
Kuwait	4,021	9,094	1,350	6,054	6,054	-
Iran	384	-	-	5,023	5,023	-
Austral	1,171	3,460	957	4,579	4,579	5,587
All other	18,741	18,462	14,887	7,563	5,662	16,546
Total	202,688	287,950	183,972	310,750	230,290	310,082
	Unit value (per barrel)					
Canada	$ 7.63	$8.20	$8.39	$8.44	$7.88	$13.85
Venez	10.35	11.50	10.59	13.22	12.93	19.71
S Arab	10.39	13.28	10.47	13.08	10.62	23.89
Kuwait	10.81	10.56	10.90	11.91	11.91	-
Iran	11.29	-	-	11.85	11.85	-
Austral	4.85	11.23	10.45	12.65	12.65	24.47
All other	7.39	10.54	8.93	15.33	14.14	22.92
Average	8.17	9.15	8.88	9.36	8.90	15.31

Source: Compiled from official statistics of the U.S. Department of Commerce.

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Table 8.--Butane: U.S. imports for consumption, by principal sources, 1976-79 and January-October 1979, and January-October 1980

Source	1976 1/	1977	1978	1979	January-October-- 1979	January-October-- 1980
	Quantity (1,000 barrels)					
Canada	0	14,684	11,707	16,909	13,381	13,262
Venez	0	3,346	753	2,372	2,214	1,258
Kuwait	0	393	0	577	577	0
S Arab	0	1,555	0	523	249	0
Iran	0	286	0	372	372	0
Libya	0	118	0	379	126	145
All other	0	626	4	411	411	1,093
Total	0	21,009	12,463	21,544	17,330	15,758
	Value (1,000 dollars)					
Canada	-	138,164	112,721	167,010	121,850	233,480
Venez	-	39,025	8,930	49,480	44,603	40,028
Kuwait	-	4,119	-	13,914	13,914	-
S Arab	-	15,567	-	11,448	4,224	-
Iran	-	2,886	-	9,773	9,773	-
Libya	-	1,260	-	9,558	3,900	3,873
All other	-	6,632	44	12,352	12,348	35,727
Total	-	207,653	121,696	273,535	210,612	313,109
	Unit value (per barrel)					
Canada	-	$9.41	$9.63	$9.88	$9.11	$17.61
Venez	-	11.66	11.86	20.86	20.15	31.83
Kuwait	-	10.47	-	24.11	24.11	-
S Arab	-	10.01	-	21.87	16.93	-
Iran	-	10.09	-	26.29	26.29	-
Libya	-	10.64	-	25.25	31.04	26.73
All other	-	10.59	10.85	30.03	30.02	32.69
Average	-	9.88	9.76	10.70	12.15	19.87

1/ Not available.

Source: Compiled from official statistics of the U.S. Department of Commerce.

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Table 9.--Natural gas and methane: U.S. exports of domestic merchandise, by principal markets, 1976-79 and January-October 1979, and January-October 1980

Market	1976	1977	1978	1979	January-October-- 1979	January-October-- 1980
	Quantity (1,000 cubic feet)					
Japan	55,040,517	51,417,659	53,850,290	55,588,902	46,330,334	33,069,878
Mexico	6,326,272	3,820,004	3,127,162	3,975,598	3,697,397	2,629,421
Austral	1/	1/	17,791	13,078	13,078	11,738
Lw WW I	1/	1/	0	7,046	7,046	0
Indnsia	1/	1/	340	10,570	10,570	2,072
Israel	1/	1/	17,181	10,164	10,164	8,054
All other	34,500,164	114,190	110,960	155,200	141,597	79,125
Total	95,866,953	55,351,853	57,123,724	59,760,558	50,210,186	35,800,288
	Value (1,000 dollars)					
Japan	91,230	95,326	111,442	122,536	101,530	146,807
Mexico	8,211	5,600	4,595	7,423	6,801	5,930
Austral	-	-	15	27	27	21
Lw WW I	-	-	-	23	23	-
Indnsia	-	-	1	19	19	4
Israel	-	-	8	18	18	14
All other	41,413	153	134	111	87	169
Total	140,854	101,078	116,194	130,158	108,506	152,945
	Unit value (per 1,000 cubic feet)					
Japan	$1.66	$1.85	$2.07	$2.20	$2.19	$4.44
Mexico	1.47	1.47	1.47	1.87	1.84	2.26
Austral	-	-	0.83	2.10	2.10	1.80
Lw WW I	-	-	-	3.29	3.29	-
Indnsia	-	-	3.15	1.80	1.80	1.80
Israel	-	-	0.44	1.80	1.80	1.80
All other	1.20	1.34	1.21	0.72	0.61	2.14
Average	1.47	1.83	2.03	2.18	2.16	4.27

1/ Less than 500.

Source: Compiled from official statistics of the U.S. Department of Commerce.

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Table 10.--Ethane: U.S. exports of domestic merchandise, by principal markets, 1976-79 and January-October 1979, and January-October 1980

Market	1976	1977	1978	1979	January-October--1979	January-October--1980
	Quantity (1,000 barrels)					
Spain	0	0	1/	1/	1/	1/
Argent	0	0	0	1/	1/	1/
U King	0	0	1/	1/	1/	0
Mexico	0	0	1	1	1	1
Japan	0	0	0	1/	1/	1/
Bahrain	0	0	0	1/	1/	0
All other	0	0	1	1/	1/	1
Total	0	0	2	1	1	2
	Value (1,000 dollars)					
Spain	-	-	1	39	39	6
Argent	-	-	-	26	26	2
U King	-	-	11	23	23	-
Mexico	-	-	8	11	11	45
Japan	-	-	-	8	8	52
Bahrain	-	-	-	8	8	-
All other	-	-	114	27	16	67
Total	-	-	134	142	131	171
	Unit value (per barrel)					
Spain	-	-	$4.14	$374.48	$374.48	$446.31
Argent	-	-	-	394.45	394.45	375.00
U King	-	-	396.04	286.86	286.86	-
Mexico	-	-	15.29	15.80	15.80	48.62
Japan	-	-	-	190.00	190.00	344.93
Bahrain	-	-	-	536.14	536.14	-
All other	-	-	77.05	83.88	69.13	78.20
Average	-	-	60.40	108.72	107.85	85.04

1/ Less than 500.

Source: Compiled from official statistics of the U.S. Department of Commerce.

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Table 11r-Propane: U.S. exports of domestic merchandise, by principal markets, 1976-79 and January-October 1979, and January-October 1980

Market	1976	1977	1978	1979	January-October-- 1979	January-October-- 1980
	Quantity (1,000 barrels)					
Mexico	2,012	1,484	1,080	1,399	1,080	803
Canada	87	57	48	43	41	18
Nethlds	1/	1/	0	4	3	6
Switzld	1/	1/	1	1	1	4
Belgium	1/	1/	1/	2	1	6
Ireland	1/	1/	1	2	2	1
All other	17	17	39	26	21	51
Total	2,116	1,558	1,170	1,478	1,148	888
	Value (1,000 dollars)					
Mexico	22,899	16,991	12,096	20,366	14,495	17,663
Canada	690	481	436	375	336	261
Nethlds	-	-	-	49	36	85
Switzld	-	-	10	40	37	45
Belgium	-	-	6	26	17	43
Ireland	-	-	5	24	20	10
All other	177	124	245	273	243	467
Total	23,766	17,596	12,799	21,155	15,184	18,595
	Unit value (per barrel)					
Mexico	$11.38	$11.45	$11.20	$14.55	$13.43	$22.00
Canada	7.63	8.44	9.03	8.72	8.15	14.78
Nethlds	-	-	-	12.57	13.24	14.00
Switzld	-	-	7.05	63.56	59.36	11.47
Belgium	-	-	21.51	12.17	12.89	11.00
Ireland	-	-	5.04	11.01	11.01	11.01
All other	6.88	7.29	6.26	10.36	11.56	9.25
Average	11.23	11.29	10.94	14.32	13.22	20.95

1/ Less than 500.

Source: Compiled from official statistics of the U.S. Department of Commerce.

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Table 12--Butane: U.S. exports of domestic merchandise, by principal markets, 1976-79 and January-October 1979, and January-October 1980

Market	1976	1977	1978	1979	January-October-- 1979	January-October-- 1980
	Quantity (1,000 barrels)					
Nethlds	1/	1/	4	326	326	0
Mexico	215	91	438	73	66	55
Canada	38	19	9	36	31	203
Japan	1/	1/	4	2	2	1/
France	1/	1/	0	1	1	2
Dom Rep	1/	1/	1/	1	1	1
All other	3	2	22	8	7	10
Total	257	113	477	447	434	271
	Value (1,000 dollars)					
Nethlds	-	-	22	3,421	3,421	-
Mexico	2,314	1,042	5,611	1,090	930	1,170
Canada	325	280	129	500	430	3,186
Japan	-	-	41	30	30	2
France	-	-	-	18	18	28
Dom Rep	-	-	5	18	18	22
All other	37	23	160	124	98	153
Total	2,676	1,345	5,967	5,201	4,945	4,561
	Unit value (per barrel)					
Nethlds	-		$5.50	$10.50	$10.50	-
Mexico	$10.76	$11.45	12.81	14.91	14.02	21.31
Canada	8.55	14.74	14.56	14.02	13.96	15.66
Japan	-	-	9.79	14.30	14.30	15.04
France	-	-	-	13.95	13.95	15.01
Dom Rep	-	-	28.51	19.30	19.30	15.00
All other	12.33	11.50	7.24	14.78	14.87	16.01
Average	10.41	12.01	12.50	11.63	11.40	16.81

1/ Less than 500.

Source: Compiled from official statistics of the U.S. Department of Commerce.

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SUMMARIES OF TRADE AND TARIFF INFORMATION

USITC PUBLICATION 841

COMPLETE LIST OF SUMMARIES PUBLISHED TO DATE IN SCHEDULE 4

Control No.	Publication date	Title
4-1,4-1	Oct. 1977	Synthetic Plastics Materials
4-4-2	July 1978	Synthetic Elastomers
4-2-3	Feb. 1981	Uranium and Uranium Compounds
4-1,2-4	Apr. 1981	Pesticides
4-9-5	Apr. 1981	Titanium Dioxide Pigments
4-2-6	May. 1981	Salt and Sodium Alkalies

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